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ABSTRACT

Research on linkages between teacher behavior and student learning is examined. Present and possible future process-outcome research is assessed with an emphasis on methodological considerations. Compilation of detailed normative data about classrooms, including explication and integration of process-process as well as process-outcome relationships, is argued for. It is suggested that large field studies addressed to classroom instruction "in general" will give way to studies designed with particular contexts in mind, using measures of both processes and outcomes (especially short-term outcomes) appropriate to these contexts. (Author/JD)

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Occasional Paper No. 25

# TEACHER BEHAVIOR AND ITS EFFECTS

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## Abstract

Recent methodological advances have produced a small but growing knowledge base concerning classroom process-outcome relationships, particularly linkages between teacher behavior and student learning of basic skills in the elementary grades. This knowledge base is expanding as related research extends into the junior high and high school levels and as follow-up treatment studies appear. In this article, present and possible future process-outcome research is assessed with an emphasis on methodological considerations. Compilation of detailed normative data about classrooms, including explication and integration of process-process as well as process-outcome relationships, is argued for. It is suggested that large field studies addressed to classroom instruction "in general" will give way to studies designed with particular contexts in mind, using measures of both processes and outcomes (especially short term outcomes) appropriate to these contexts.

# Teacher Behavior and its Effects[1]

Jere E. Brophy[2,3]

## Introduction

The past several years have been exciting and gratifying for classroom researchers concerned with process-product (outcome) relationships because a coherent body of knowledge linking teacher behavior to student achievement and, to an extent, attitudes has begun to emerge. For achievement outcomes at least, such linkages had proven difficult to establish, even as recently as the early 1970's (Dunkin & Biddle, 1974; Rosenshine & Furst, 1973). Stephens (1967) even theorized that achievement is determined by factors within students and little, if at all, by teachers. As late as 1972, research seemed to support this. The Coleman report (Coleman, Campbell, Hobson, McPartland, Mood, Weinfield, & York, 1966) and its reinterpretations by Mosteller and Moynihan (1972) and by Jencks, Smith, Acland, Bane, Cohen, Gintis, Heyns, & Michelson (1972) seem to indicate that teachers do not have important effects on student learning. Popham (1971) reported no systematic differences in teaching behavior between trained instructors and comparison groups without special training, leading him to question whether teachers have any special expertise at all. Heath and Nielson (1974) criticized and

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[1]This paper appears in the December, 1979 issue of the Journal of Educational Psychology.

[2]Jere Brophy is coordinator of IRT's Classroom Strategy Study.

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rejected the process-product research through 1970, concluding that there was no empirical basis to support the then-popular performance-based approach to teacher education.

Much of the educational "establishment" seemed to accept and even welcome such conclusions. Many writers romanticized teaching as an art: "good teachers" are born, not made. Such people feel no need for research on teaching, and may even reject it on the ground that "you have to find out what works for *you*" (for a recent and unusually sophisticated version of this argument, see Fenstermacher, 1978). Many others are more interested in curriculum than in methods. They hold that students will learn what they are taught, and often cite Walker and Schaffarzick's (1974) review, as if it supported their position. That review does indicate the importance of curriculum in determining what is learned, but it did not investigate teaching methods and says nothing about their importance, either in absolute terms or in comparison to curricula. It seems intuitively obvious that educational outcomes will be determined by both what is taught (curriculum) and how well it is taught (method) and that both aspects need investigation.

Another group likely to ignore or discount research on teaching is composed of people who are interested in method, but who believe that they already have all the answers. Dunkin and Biddle (1974) observed that premature and rigid commitment to particular methods has caused many educators to act as if these methods were already documented rather than to generate information about their effectiveness. These people judge teaching subjectively, according to its degree of fit with their value systems, rather than by trying to collect objective information about its effects. In combination, the factors of romanticizing teaching as an art, concern with curriculum rather than

method, and inappropriate commitment to methods minimized response to Medley and Mitzel (1963) and previous reviewers who called for more, and more objective, research on teaching.

The situation began to change in the early 1970's. Influential reviews by Rosenshine and Furst (1973) and by Dunkin and Biddle (1974) helped pull together and define the field. Social concern about declining student achievement, teacher accountability, and related issues led to an increased stress on student outcomes as criteria for teaching effectiveness. The National Institute of Education began to fund research to speak to these issues, and perhaps equally important, helped to facilitate communication among researchers in the field and to develop a planned agenda likely to yield cumulative findings. The result has been a proliferation of research on teaching, conducted mostly by people who are not strongly committed to particular methods and thus are willing to "listen to the data." This has produced a steady accumulation of sensible and often replicated findings that constitute a growing knowledge base about process-product correlations and, to a lesser degree, causal relationships.

This effort began with several large scale field correlational studies conducted at various elementary grade levels (Berliner & Tikunoff, 1977; Brophy & Evertson, 1976; Brophy & Evertson, Note 1; Good & Grouws, 1977; Good & Grouws, Note 2; McDonald, 1976; McDonald, Elias, Stone, Wheeler, Lambert, Calfee, Sandoval, Ekstrom, & Lockheed, Note 3; Soar & Soar, 1972; Stallings, 1975; Stallings & Kaskowitz, Note 4; Tikunoff, Berliner, & Rist, Note 5). These studies varied in the types of teachers and students included, the kinds of variables addressed, and the methods used, but there was sufficient overlap and replication to provide a dependable body of knowledge about the relationships between teaching, particularly direct instruction, and student learning of basic skills

in the elementary grades. Since then, other studies have built on these results and the studies themselves have been extended by replication to the junior high and high school levels (Evertson, Anderson, & Brophy, Note 6; Stallings, Note 7) and by experimental studies designed to test hypotheses developed from earlier correlational work (Anderson, Evertson, & Brophy, Note 8; Good & Grouws, Note 9; Program on Teaching Effectiveness, Note 10).

These findings have been reviewed in detail elsewhere (Borich & Fenton, 1977; Brophy, Note 11; Gage, 1978; Good, 1979; Medley, 1977; Rosenshine, 1976, 1979; Rosenshine and Berliner, 1978), so a systematic review will not be attempted here. A few sets of findings (drawn mostly from my own work) will first be summarized to illustrate the kinds of relationships being discovered, but the rest of this paper will focus mostly on current trends and methodological issues.

The findings discussed below are among the more interpretable and better replicated of those produced by process-product research, but even so, several qualifications should be mentioned. One is that they come mostly from research on basic skills instruction in the early grades, typically (but not always) in schools serving primarily low socioeconomic status populations. This introduces the potential problem of narrow limits to generalization; in fact, when researchers have built context comparisions into their studies, they have found contrasting process-outcome relationships in contexts that differed in subject matter, grade level, student socioeconomic status or ability level, or other factors (Brophy & Evertson, 1976, 1978, Note 1; Evertson, Anderson, & Brophy, Note 6; Good, Ebmeier, & Beckerman, 1978; McDonald, et al., Note 3; Medley, 1977; Murnane & Phillips, Note 12; Stallings, et al., Note 7; Tikunoff, Berliner, & Rist, Note 5; Trismen, Waller, & Wilder, Note 13).

As data accumulate, the influence of context is being recognized as more and more important. In fact, although there may be a few truly universal instructional principles (e.g., match level of instruction to student ability), there do not appear to be any universal teaching competencies (i.e., specific behaviors such as praising or asking higher level questions) that are appropriate in any and all teaching circumstances (Brophy & Evertson, 1978; McDonald, et al., Note 3). Teachers must not only master particular skills, but know when to use them. Consequently, research linking teacher behavior to student outcomes can provide input into teacher education and teacher accountability schemes, but it does not translate into lists of fixed, "universal" learning objectives or evaluation criteria (for a somewhat different view, see Gage, 1979).

Another major qualification on the findings to be reviewed is that they stress cognitive outcomes (especially scores on standardized achievement tests) over affective outcomes. Studies that have looked at both kinds of outcomes frequently find that teacher behaviors associated with cognitive outcomes are different from and sometimes contradictory to those associated with affective outcomes, so that tradeoffs are involved (Brophy & Evertson, Note 1; Evertson, Anderson, & Brophy, Note 6; Good & Grouws, Note 2; Medley, 1977; Solomon & Kendall, 1976). Thus, elements of approaches to teaching must be orchestrated into systematic methods that fit the needs of students as seen by teachers or policy makers. Research on teaching can provide scientific support for educational policy decisions, but it cannot dictate such decisions.

## Direct Instruction

In general, students taught with a structured curriculum do better than those taught with more individualized or discovery learning approaches, and those that receive much of their instruction directly from the teacher

do better than those expected to learn on their own or from one another (Bennett, 1976; Gage, 1978; Good, 1979; Inman, Note 14; McDonald, et al., Note 3; Rosenshine, 1976; Stallings, et al., Note 7; Stallings, & Kaskowitz, Note 4; Wright, 1975; Zimmerman & Jaffe, 1977). Teacher talk in the form of lectures and demonstrations is important, as are the time honored methods of recitation, drill, and practice (Brophy & Evertson, 1976, Note 1; Good and Grouws, Note 2; Greeno, 1978; McDonald, et al., Note 3). It appears that most forms of open education or individualized instruction involve unrealistic expectations about the degree to which students in the early grades can manage their learning independently (For a contrasting view, see Peterson, 1979).

Students' opportunity to learn materials is a major determinant of their learning (Berliner, 1979; McDonald, et al., Note 3; Rosenshine & Berliner, 1978; Stallings & Kaskowitz, Note 4; Wiley & Harnischfeger, 1974). This is indexed both by the time scheduled for instruction (allotted time) and the time actually engaged in learning activities (engaged time). There is great variability in both (Fisher, Filby, Marliave, Cahen, Dishaw, Moore, & Berliner, Note 15; Stallings, & Kaskowitz, Note 4). Allotted time depends largely on finances and policy decisions by school officials, but engaged time within this allotted time depends mostly on the classroom teacher's goals and managerial skills. Teachers who produce substantial achievement gains in their students tend to have most of the characteristics identified by Kounin (1970) as keys to effective classroom management (Anderson, Evertson, & Brophy, Note 8; Brophy & Evertson, 1976, Note 1; Good & Grouws, Note 2). These include: withitness (monitors the entire class continuously); overlapping (can do two or more things simultaneously without having to break the flow of classroom events); signal continuity, smoothness, and momentum (moves activities

along at a good pace, without confusion or loss of focus); and variety and challenge in seatwork (provides seatwork that is at the right level of difficulty for students, and interesting enough to hold their attention). The group alerting and accountability techniques (being deliberately unpredictable in questioning patterns, frequently calling on non-volunteers, and calling on students to comment on other students' answers) mentioned by Kounin have not been well supported (Anderson, Evertson, & Brophy, 1979, Note 6; Brophy & Evertson, 1976, Note 1; Good & Grouws, Note 2), apparently because really effective classroom managers should not have to rely on these techniques (see discussion by Brophy & Putnam, 1979). In any case, Kounin's conclusion that the keys to effective classroom management lie in creating an effective learning environment and consistently using preventive techniques (and not so much in using effective methods of dealing with misconduct after it occurs), has been well supported.

Recent work suggests that classroom management skills correlate with student learning gains not only because skilled classroom managers maximize student engagement on tasks, but because good managers also tend to be good instructors, and vice versa (Evertson & Anderson, Note 16). Both aspects of teaching involve similar elements of preparation and organization skills, and many aspects of classroom management are essentially instructional tasks requiring the teacher primarily to show the students what to do rather than to motivate them to do something they already know how to do (Brophy & Putnam, 1979).

Input: Expectations, Pacing

Pacing is the speed with which students move through the material to be learned. This can refer to the curriculum as a whole (how far along is the class on March 1st?) or to particular lessons and activities.

Theoretically, rates of pacing should show curvilinear relationships with amount learned (Jorgenson, 1977); the most successful teachers should be those who move students along at the pace that requires them to work continually up to their capacities. Typically, however, the data reveal simple positive relationships, with the more successful teachers being those who are task oriented and businesslike in moving the class along at a brisk pace (Barr, 1975; Carnine, 1976; Good & Grouws, Note 2; Good, Grouws, & Beckerman, 1978; Grole & Pettibone, 1975). Apparently, the scope and sequence of the typical American school curriculum allows for a relatively leisurely pace, so it is reasonable for teachers to try to move through the material efficiently.

Bear in mind, however, the distinction between (inappropriately) trying to teach students material that is too difficult for them versus (appropriately) teaching material that is at the right level of difficulty but moving them through it at a brisk pace. Data on pacing support the latter approach, but not the former. In fact, other recent data stress the importance of presenting tasks that allow high levels of learner success (Becker & Engelmann, Note 17; Crawford, 1978; Good & Grouws, Note 2; Jorgenson, 1977). Brophy and Evertson (Note 1) found that during recitations, where the teacher is present to provide feedback and help, about 75% of the questions that relatively successful teachers ask are answered correctly (the percentage is a little higher in low ability classes). For seatwork assignments, where the teacher is not monitoring performance continually, success rates will have to approach 100% if students are to be expected to work continually on the assignments until completed.

In general, then, successful teachers move students briskly from step to step, but the steps themselves are kept small, easily within the

grasp of most students. Contrary to several lines of theorizing popular in the 1960's, there seems to be little point in asking difficult or complex questions in the belief that they will stimulate greater learning, although they may affect types of learning (Berliner, 1979; Dunkin & Biddle, 1974; Gall, Ward, Berliner, Cahen, Winne, Elashoff, & Stanton, 1978; Soar & Soar, 1972).

Several aspects of pacing, and of general student opportunity to learn, are affected by teachers' expectations. Both naturalistic and experimental investigations have shown that teacher expectations can and often do affect how much students learn (see reviews by Braun, 1976, and Brophy & Good, 1974), and this factor comes up frequently in recent research on teacher effects. Typically, the more successful teachers have a "can do" attitude, perceiving their students as capable of learning the material and themselves as capable of teaching it to them effectively. These teachers set higher goals than other teachers, and they are more persistent in laboring to meet those goals and overcoming obstacles if necessary (Brophy & Evertson, 1976).

Another factor connected with pacing and expectations is the degree to which the teacher involves all students, not just a subset. Where teachers have low expectations for certain students, they may skip over them during classroom recitations or discussions, and may address themselves more to controlling conduct than to instruction in the curriculum (Brophy & Good, 1974). Several recent studies have found that teachers successful in producing student learning gains provide a greater academic focus, not only in directing questions to the class as a whole, but in dealing with individual students. During small group instruction, for example, they are likely to move around the group in a predetermined, fixed order rather than to call on students "randomly," and likely to provide individual

attention to each student and insure that each receives "high quality" response opportunities and feedback when called upon to recite (Anderson, Evertson, & Brophy, Note 8; Brophy & Evertson, 1976, Note 1). In summary, learning gains are most impressive in classrooms where students receive a great deal of instruction from, and have a great deal of interaction with, the teacher, especially in public lessons and recitations that are briskly paced but conducted at a difficulty level that allows consistent success.

Context-Specific Relationships

Recent research from the primary grades (Brophy & Evertson, Note 1; Stallings & Kaskowitz, Note 4) seems to flatly contradict elements of the style of "indirect teaching" that Flanders (1970) has advocated, by revealing either no significant correlations or significantly negative correlations with learning gains for such variables as student talk, use of student ideas, and praise of good student responses. Although Flanders apparently overstated the case supporting indirect teaching (see Barr & Dreeben, 1977), his data do suggest that greater student learning at the middle and upper grade levels is associated with: high frequencies of student talk relative to teacher talk or periods of silence or confusion, teacher use of student ideas (by eliciting them frequently in the first place and then integrating them into the discussion as it develops), and praise of good contributions by students.

The Texas Junior High School Study (Evertson, Anderson, & Brophy, Note 6) addressed this problem, working from the hypothesis that the apparently conflicting findings actually were all correct (that is, that different teaching methods were appropriate in the lower vs. the higher grade levels). As expected, this study did reveal that student talk, use of student ideas, and praise of student contributions

correlated positively with learning gains in seventh- and eighth-grade math classes (the data for English classes were inconclusive).

Evertson, Anderson, and Brophy did not interpret this as support for the larger concept of indirect instruction as elaborated by Flanders, however, because student talk, use of student ideas, and praise are associated with the public, whole-class lesson format featuring presentation of information by the teacher along with recitation and discussion by students. They also pointed out that the student talk involved was not just any student talk, but student talk occurring within teacher structured academic activities, and that use of student ideas and praise of good student contributions are more likely to be effects of more fundamental teacher behaviors than to be major causes of student learning in their own right. In any case, the research is consistent in revealing contrasting patterns of relationship between these variables and student learning in the lower versus the upper elementary grades.

A different context-specific pattern appears for the variable of challenging/demanding versus encouraging good performance from students (Brophy & Evertson, 1976, Note 1; Evertson, Anderson, & Brophy, Note 6; Good & Beckerman, 1978; Medley, 1977; Solomon & Kendall, 1976). Teachers working with high socioeconomic status/high ability students generally are most successful if they move along at a rapid pace, continually communicating high expectations and enforcing high standards. They try to keep the students challenged and refuse to accept inferior work, occasionally criticizing or punishing students for such work where necessary. Teachers who are generally most successful in low socioeconomic status/low ability settings are equally determined to get the most out of the students, but they usually do so by being warm and encouraging rather than more businesslike and demanding. They are more personal with the

students, taking out more time from academics to try to motivate them or deal with their concerns; they praise and encourage much more often and minimize criticism (of poor work, not necessarily inappropriate conduct); and they move through the curriculum at a slower pace, allowing more time for practice (but they still move at a good pace relative to other teachers working with similar groups). When they call on individual students during recitations, they are more likely to allow more time to respond or to provide help by giving hints or rephrasing the question than to simply give the answer or call on someone else (Brophy & Evertson, 1976, Note 1).

These have been just two examples of how what constitutes appropriate teaching behavior can vary according to context. Others are discussed by Brophy (1978), Brophy and Evertson (1978), Good and Brophy (1977), and Good and Power (1976).

## Methodological Improvements

Space limitations preclude further review of recent research linking teacher behavior to its effects, but what has been presented should be enough to illustrate two of its important features. First, most of the variables studied are "educational," rather than "psychological." They refer to the classroom behaviors of teachers, usually describing them in terms like those teachers use themselves. Second, most of this research is heavily empirical; it is guided by no systematic theory and, in fact, uses very little theory at all. Many observers see this as a problem (e.g., Barr & Dreeben, 1977), but I believe that classroom research is still in its infancy (very little educational research has included systematic measurement of classroom processes), so that the build up of a large volume of reliable and replicated data about classroom processes is vital. Such data will require explanatory concepts to tie them

together, but they will constitute "grounded" mini-theories, and not the premature, overly abstract, and grandiose theories that have plagued the field to date.

In the early stages of any science, it is typical for advances to be tied to improved tools and techniques rather than to better theory, and research on the classroom has been no exception. Consequently, I will devote the rest of this paper to consideration of the remarkable methodological advances that have occurred in recent years, and to a consideration of where research on teaching might be heading.

Dunkin and Biddle (1974) noted that classroom research involves four broad categories of variables: (1) presage (background characteristics, attitudes, beliefs, expectations, and abilities that teachers and students bring into the situation under study), (2) context (grade level, subject matter, immediate instructional objectives, and other particulars of the situation and setting), (3) process (observable teacher and student behavior, including teacher-student interaction), and (4) product (variables indexing the outcomes of instruction, typically student attitudes and achievement). They concluded that the biggest single problem with the research they reviewed had been failure to take into account context variables in designing research, reporting it, and speculating about generalizability.

Subsequently, many researchers have heeded their advice, at least to the extent of confining their data sources to well defined and well described contexts. A few have "built context into the design" by allowing for separate data collection and tabulation, and thus later comparison, of classroom processes occurring in different contexts. Examples of contexts built into my own research include student social class/ability level, grade level, and subject matter, as well as finer distinctions such as whole class versus small group versus individualized

teacher-student interactions; teacher versus student initiation of interaction; academic versus procedural versus social versus personal interactions; feedback following correct answer versus incorrect answer versus failure to respond; and new reading versus recitation versus drill in reading groups. Building such distinctions into the research design makes it possible to discover that, for example, teacher praise of good academic work by the student tends to correlate positively with achievement if it occurs during teacher initiated interactions, but negatively if it occurs during student initiated interactions, (Brophy & Evertson, Note 1), or that different teacher strategies are indicated when students fail to respond to a question rather than answer it incorrectly (Anderson, Evertson, & Brophy, 1979).

Dunkin and Biddle (1974) also contributed other methodological suggestions, as did Good, Biddle, and Brophy (1975) and the participants in a national conference convened in 1974 by the National Institute of Education (Note 18). Some of the more important of these, which were incorporated to some degree into many of the studies done in the last few years, are the following: use the teacher as the unit of analysis (not the school or school district); include a large enough sample of teachers to allow statistical analysis (this applies to all subsamples as well, *if* the design calls for comparison of these subsamples); select samples rationally, not randomly, matching classrooms in different groups as closely as possible; use a pre-post rather than a post only design in order to control for student entry characteristics, especially if classrooms have not been matched in the first place; use a multi-faceted approach to data collection, featuring a variety of high and low inference measures of teaching, ranging from ethnographic description to highly systematized and quantified low inference coding systems; use

a variety of outcome measures, attending to affective as well as cognitive outcomes and allowing for a variety of cognitive outcomes rather than just one; base the data on analytic or psychologically meaningful units (percentage of correct answers that were praised) rather than arbitrary time units (rate of praise per hour) or ad hoc phenomenological units that are unique to each individual coder (high inference praise rating or vague observer impression of use of praise); include in the report tables with simple, descriptive statistics tied to these units, so that the reader can get a sense of the relative frequency and the degree of variability observed for each variable; include presage, context, process, and product variables simultaneously within the same design where possible, preferably one that allows comparison of two or more groups; replicate systematically across other rationally chosen samples.

Most of these design features are familiar and apply to *any* good research, not just classroom research, yet few of them were incorporated into classroom research until recently, and no study has yet incorporated all of them. They will not be discussed further here, except for two comments, because they are discussed at length in the three sources referenced above and in more recent methodological papers (Berliner, 1977; Borich & Fenton, 1977; Good, Biddle, & Brophy, 1975; Kennedy & Bush, 1976; Koehler, Note 19).

The first comment is that context still seems to be of primary importance. Most of the interesting new findings are context-specific, and are revealed because the investigator discovers yet another important context variable and develops a way to build it into the research design. The second comment is that the principle violated most frequently is one of the most basic: collecting enough data to support reliable and valid scores.

Many otherwise well designed and even heavily funded studies have tried to base conclusions on just a few hours of classroom observation, when five or 10 times that amount would have been more appropriate (given the variables under investigation). A few brief visits might be sufficient for reliable general ratings of classroom atmosphere or teacher characteristics such as warmth or enthusiasm, although even here, one should avoid test periods, drills, and other activities that preclude adequate observation of the variable of interest. Much more extended observation is usually required, however, to study questioning styles, provision of feedback to students, clarity of explanations, and most variables relating to the quality of instruction. Attempts to discuss such variables on the basis of a few brief visits to a classroom are roughly comparable to attempts to discuss personality on the basis of a 10-item test.

Attempts have been made to approach this problem quantitatively via applications of generalizability theory (Shavelson & Dempsey, 1976). These are not likely to be of much practical use to classroom researchers in the near future, however, because so many different variables are addressed in a single study (each with its own generalizability statistics) and because collection of generalizability information could easily be more expensive than conducting the substantive research itself. Also, the stability of classroom process measures from one observation to the next (which determines their generalizability statistics) usually depends more on the researcher's control over context factors than on observers' reliability in coding the process variable. Many process variables (probably most) are stable within contexts but not across contexts (Brophy & Evertson, 1978; Brophy, Evertson, Crawford, King, & Senior, Note 20; Evertson, Anderson, Edgar, Minton, & Brophy, Note 21). For the moment,

then, it appears that investigators' degrees of success in making sure that they collect enough data *per classroom* to allow meaningful study of a given process variable will continue to depend on their familiarity with the classrooms of interest, the process variable itself, and the context factors that affect it.

## Recent Trends

Contemporary researchers studying teaching can point with pride to solid advances in the field, but the knowledge base dissipates quickly beyond basic skills instruction in the early grades. Researchers need to pay attention to different instructional contexts and to teaching goals other than achievement gains, to explicate existing findings, and to systematically extend the range of classroom events they can comprehend and control. Before offering ideas on how to do this effectively, I want to mention a few recent trends that I believe are counterproductive.

One is the trend toward case studies (usually ethnographic) in place of research on larger samples of classrooms. We do need "thick description," and all kinds of educational research would benefit from more of it (See Evertson & Anderson, Note 16 and Tikunoff, Berliner, & Rist, Note 3, for examples of thick description in studies involving samples of teachers large enough to permit statistical analyses). However, a sample of one is still a sample of one, with all of the restrictions on reliability and generality that this implies. Also, the perceptions and inferences of a single observer must remain suspect until verified independently, despite "triangulation" and other methods that sophisticated ethnographers have developed to maximize objectivity (Erickson, Note 22; Magoon, 1977; Wilson, 1977). This is easily forgotten. For example, Rist's (1970) case study of a single class of children followed from kindergarten through second-grade is often cited as "proof"

that teachers systematically discriminate against low achievers and have strong negative self-fulfilling prophecy effects on their achievement and self-concepts. Actually, this case study (a fine one, but still a case study) proves nothing at all about teachers or students beyond this very limited sample, and a great deal of more controlled research is available to indicate that such negative self-fulfilling prophecy effects are neither as widespread nor as powerful as early studies had suggested (see reviews by Brophy and Good, 1974, and Braun, 1976).

A second problem is premature experimentation. In general, I support Rosenshine and Furst's (1973) call for systematic progress through cycles of observation, correlation, and experimenation, with verification of case studies and individual observations on larger samples, and teasing out of causal relationships within correlational data through experimentation. However, one can move too quickly from correlation to experimentation. Before rushing to make a classroom process variable the independent variable to be manipulated in an experiment, it is worth exploring the correlational relationship itself at greater length, in order to develop "grounded theory" (Yinger, Note 23) to guide experimentation. Does the relationship replicate? (Many do not.) If so, what are the limits of replication? Does the relationship vary with context? What might this imply about cause-effect relationships or about other variables that might have functional relationships with this one?

When such questions are applied to a variable like teacher praise of good student answers or work, it becomes clear that the direction and intensity of relationships of praise to student learning vary with context, and that praise may be better characterized as an outcome of other classroom events that cause student learning than as a cause of such learning in its own right. Also, to the extent that praise is

causal, experimental variation of it is likely to be a very weak treatment without control over some of these other variables. At present, our knowledge about praise and about the classroom generally is not yet detailed enough to enable us to design experiments which would *both* involve sufficient control over other variables to allow a test of the specific effects of praise, and retain sufficient "ecological validity" (Bronfenbrenner, 1974) to allow the obtained results to generalize to the naturalistic setting.

A related problem with experimental studies is that no single instructional variable is likely to control enough of the variance in student learning to produce significant results when varied systematically. This has been the downfall of most attempts at educational experimentation, including the elegantly designed studies of structuring, soliciting, and reacting carried out by Gage and his colleagues (Clark, Gage, Marx, Peterson, Stayrook, & Winne, in press; Program on Teaching Effectiveness, Note 24) and of probing, redirection of questions, cognitive level of questions, and recitation carried out by Gall, et al., (1978). It is possible to strengthen treatments by lengthening them and broadening their scope (Brophy, Note 25; Snow, 1974), however, and recent experimental studies which have done so have yielded significant treatment effects (Anderson, Evertson, & Brophy, 1979, Note 8; Good & Grouws, 1979, Note 9; Program on Teaching Effectiveness, Note 10), although at the cost of a reduction in the capacity for drawing tight causal inferences from the data.

A third trend that I see as unprofitable is infatuation with "testing" simplistic models that "explain" variance in student learning by entering predictor variables into multiple regression or path analyses.

These analyses are artificial and misleading. Despite the trappings of hypothesis testing and the use of terms such as "explain" or "control" (the variance), no experimentation is done, no genuine causal inferences can be drawn, and nothing is revealed beyond what could be determined from inspecting partial correlations or other analyses of each separate teaching variable.

This in itself would not be a serious problem. However, preoccupation with such "predictive" analyses often steers investigators away from more substantive analyses that might generate useful knowledge about teaching. That is, especially in studies involving multiple regression equations to predict outcomes, investigators sometimes concentrate on maximizing predictive accuracy rather than on unearthing and explicating process-outcome and process-process relationships. Often, factor analysis, logical analysis, or other methods are used to combine individual scores into larger clusters. This increases the reliability of cluster scores, which is desirable for prediction purposes, but it reduces their meaningfulness, as well as any implications they might have for understanding teaching. This appears to have occurred, for example, in the work of Soar and Soar (1972) and McDonald, et al. (Note 3).

In a more extreme case, one recent study failed to produce any useful information at all because data were reported only for combination scores made up of a great many individual variables (Cooley & Leinhardt, Note 26). These combination scores had little face validity (variables that seem to have little to do with classroom management were included on a classroom management combination score, and other variables that do seem to be part of classroom management were omitted from this score but placed on other scores presumably measuring, for example, instructional methods). Also, many variables were weighted and them summed together

in the same direction when other data indicated that these variables correlated in opposite directions with student learning (for example, academic questions usually correlate positively with learning, but personal or procedural questions usually correlate negatively; both types of questions were added together on the same variable). This study might have yielded sensible relationships if analyses had been based on individual variables, but the analyses based on combination scores yielded essentially nothing.

It should be noted here that analysis of each process variable individually is not simple, either conceptually or procedurally. Hundreds of variables may be involved, and these can yield thousands of significance tests if each variable is measured separately across several contexts and if several outcome measures are used (cf. Evertson, Anderson & Brophy, Note 6; Anderson, Evertson, & Brophy, Note 8). Under these circumstances, probability values became merely informal guides to interpretation rather than bases for decision making about which relationships to take seriously and which to assume are due to chance. Interpretation is guided by factors such as the degree to which individual findings fit together into patterns (regardless of whether they cluster on common factors statistically) and the nature and degree of changes observed in these patterns across different contexts. It can even be constrained by decision rules specifying probability values and distribution characteristics. Ultimately, though, it depends on the investigator's familiarity with the data and the classrooms from which they came. This approach to data analysis has been rightly criticized as cognitively overwhelming (Barr and Dreeben, 1977) and as vulnerable to subjective bias (Rosenshine, personal communication), but I believe that there is no substitute for it at present. Clustering approaches tend to mask more than they reveal.

## Future Prospects

Having identified a few present trends that I see as unprofitable, I will devote the rest of the paper to consideration of research questions and design features that I believe should receive more emphasis. First, because I believe that research on teaching is still in its infancy despite recent advances, I think that more than anything else it needs to develop and solidify an empirical base of reliable information about process-process and process-outcome relat'onships. There are still few normative data on even traditional classrooms, so it is difficult to know what to expect, and thus difficult to judge whether relationships observed in a particular study are sensible and "normal," or aberrant due to atypical students, classroom organization, curricula, or other factors. Also, in their concern about outcomes and process-outcome relationships, most investigators have neglected serious analyses of process measures and process-process relationships. Process measures cannot be taken for gra.ted, even if measured very reliably, because they sometimes mean something other than what they appear to mean, or what the investigator intended when designing the coding system (Borich, Malitz, & Kugle, 1978).

For example, my experience in coding teacher praise suggests that this classroom process variable usually includes all of the following: (1) attempts by the teacher, whether spontaneous or calculated, to express approval of a student's academic performance (this is usually what we mean by praise, but even here, its quality and probable effects will vary with its degree of spontaneity, specification of the behavior being praised, and fit w.th student's expectations and desires); (2) attempts to apply the principle of vicarious reinforcement, which are not so much genuine praise but attempts to motivate or control the

behavior of someone other than the student being "praised" ("I like the way Johnny cleaned up his desk and is ready to go to lunch."); (3) "consolation prize" praise, which is not genuine praise of good performance but instead is an attempt (usually weak and ineffectual) to encourage or reinforce a student who has done poorly; and (4) "say something positive" praise that also is not genuine praise of good work but is an attempt by the teacher to say something positive (which often turns out to be meaningless or clearly incorrect) to an alienated or difficult student in an attempt to maintain communication or avoid conflict when attempting to control the student's behavior. All of these teacher messages ordinarily would be coded as praise based on their verbal content, but they have very different meanings and functions, usually recognized by both teachers and students.

Thus, a seemingly clear cut measure of a specific classroom variable can be subdivided into several variables when it is analyzed more carefully. This is probably true of most of the classroom process variables typically studied in research on teaching, indicating the need for both more data and more analysis of existing data. This will require sustained observation leading to thick description in which to embed and from which to interpret classroom process variables and their relationships. Researchers will need to be familiar enough with the classrooms they are studying to understand how these classrooms operate as systems, so they can see process variables not only in isolation but as parts of a dynamic system that interrelate with one another and with parts not being specifically measured.

Attention to research design is also important. To date, there has been much sophistication and concern about statistical analyses (perhaps too much) but not about research design. Yet, the quality and ultimate

value of data depend more on the design characteristics discussed by such authors as Sidman (1960), Campbell and Stanley (1963), or Snow (1974) than on the methods used to analyze data once they are collected. Consider the Coleman report (Coleman et al., 1966). The expensive and detailed analyses performed by the original authors and the numerous re-analyses performed by other investigators could not overcome the inherent limitations of the weak data base in this study, particularly the use of the school rather than the teacher as the unit of analysis and the lack of classroom observation data (Alexander & McDill, 1976; Good, Biddle, & Brophy, 1975).

I am arguing for a middle course between what I see as unprofitable extremes. One is ethnographic study of the single case, which cannot be generalized because of its unique nature and the unique perspective of the single observer. The other extreme is the large study that includes a great number and even variety of classrooms but involves little or no systematic observation of classroom processes. Large sample sizes cannot compensate for data bases restricted to a few minutes or a few hours per classroom, so the result is an expensive and relatively uninformative study such as those conducted to evalute Project Headstart or Title One programs. These studies tell how the special classes are doing compared with other classes, but they yield essentially no information about what kinds of classroom teaching are ideal or appropriate for the special classes.

More informative studies would include a large enough sample of classrooms to make comparison and generalization possible, but also a strong and sophisticated data base consisting of extended classroom observations in each classroom. Thus, a study involving 20 classrooms studied for 20 hours each is almost certainly going to be more valuable

than a study of a single classroom for 400 hours or a study of 400 classrooms for one hour each, other things being equal (i.e., sophistication of research design).

Another important step will be to move beyond the now well established relationship between time on task/student engagement/teacher classroom management skills and student learning. The results of several major studies can be reduced to these relationships, and the same relationships account for many of the findings of the rest. At this point, researchers no longer need to replicate these findings; instead, they need to go beyond them in order to observe other relationships. The influence of teacher classroom management skills is pervasive, often strong enough to mask the influences of more limited and context-specific instructional skills. To study these instructional skills effectively, researchers will need to control, or at least limit, the variation in classroom management skills. This is not easily done, because management and instructional skills overlap and interact in their effects on students (for example, student attention at the beginning of a lesson is heavily dependent on management skills, but attention during the lesson also depends on, and in fact can be seen as a short term outcome of, instructional skills). At minimum, though, we could exclude teachers with very poor management skills from studies directed at instructional techniques.[4]

The same is true of other factors that can affect the success of research on instruction. Consider the match between the curriculum (what

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[4] In calling for control of management skills in order to study instructional skills, I am not suggesting that management skills are unimportant or do not require more study. Obviously, more knowledge of how to manage various kinds of classrooms effectively is needed. When the intent is to study instructional skills, however, management skills will need to be controlled.

is to be taught, including the materials and exercises that will be used) and the students' levels of knowledge and skill. Unless the curriculum is at the right level of difficulty, challenging but not so new or hard as to preclude mastery, there is little point in trying to study the relative merits of various instructional techniques.

Measurement of classroom processes will have to continue to improve, despite the increasing sophistication seen in recent years. One way is to continue to go beyond simple frequency scores, scaled per unit of time. Time is not a psychologically meaningful variable in teaching (for example, teachers do not plan to ask so many questions per hour; they plan to ask sequences of questions designed to elicit particular facts or conclusions). Ratio or proportion scores (percentage of correct responses praised) allow better comparisons across teachers than frequency scores (number of praise statements per hour). Other measurement needs include better ways to express teacher behavior that occurs in sequences and more attention to the quality of teacher behavior, not just its quantity. In coding teacher questioning, for example, both of these goals could be addressed by using the sequence -- not the individual question -- as the unit of coding and analysis. In addition to computing the percentages of various types of questions, investigators would score sequences of questions for logical or theoretical qualities and note whether or not the question sequences produced their stated objectives.

It will also be important to go beyond verbal interaction by developing more and better ways of taking into account the full range of classroom events. A great many important but as yet undiscovered determinants of student learning will be found by studying such variables as the kinds of assignments teachers make, the ways these assignments are presented and explained, and the methods teachers use to monitor performance on the assignments and provide correction. Ideas

about what some of these non-interactive variables are and how they might be measured must come initially from ethnographic observation, followed up later with more controlled research on large samples.

This is not a plea for more (but better) large field studies involving observing over the school year and relating process measures to student performance on standardized achievement tests. Such studies have made important contributions, but we may be reaching the point of decreasing returns from them. Certain features should probably be retained, especially the commitment to data collection in classroom settings and the development of an extended data base through repeated observations. However, as the field develops, researchers will need to focus on more specific settings, and perhaps control the settings to a degree (but not so much as to preclude generalization). Observation categories would be developed with particular contexts in mind, and data would be collected and analyzed within these contexts.

Pulling together several of these recommendations, I foresee studies confined to specific classroom contexts, such as: presenting new information in demonstration or lecture, conducting discussion of previously presented or read material, conducting drill or recitation to provide practice and informal assessment, assigning work and giving instructions about how to do it, monitoring seatwork (correcting errors, diagnosing the reasons for them, reteaching), and testing. These contexts seem sufficiently different from one another that combining data across them will probably mask orderly relationships that might be discovered by studying them separately. In fact, it is likely that most research on teaching done to date has involved such masking.

Each context has its own short-term objectives, and these determine the short-term outcome measures that could be used in studying them.

For most research purposes, it will be important to insure that the curriculum (broadly defined as above) is appropriate to the students' abilities, and that the students are at least minimally attentive and cooperative. However, variables like student attention and cooperation could be monitored and used as short term outcomes of the activity as well.

For the context "presenting new information in a demonstration or lecture," short term objectives could include efficient communication of the information, student comprehension and retention of it, and students' ability to apply it later in follow up assignments or in their everyday lives. Comprehension could be indexed through negative indicators like non-verbal signs of confusion or questions requiring the teacher to repeat or clarify, as well as positive indicators like non-verbal signs of comprehension, questions asking the teacher to elaborate, or student initiated elaborations. Retention could be measured by tests, application by follow up assignments, and interest by the degree to which students initiate follow up actions.

Identifying reasonable short-term learning objectives and developing ways to measure them should not be difficult: existing research linking variables like task engagement and performance on assignments to scores on end-of-year achievement tests provides support for the validity of such measures.

The task is much more difficult in the affective domain where progress has been disappointing to date (except for task engagement and related measures). Despite the frequent identification of process-outcome research with stress on cognitive outcomes, the problem is not lack of researcher interest or ideas about teacher behavior

that might affect affective outcomes. Instead it is the absence of credible measures of affective outcomes. It seems clear that the pen and paper self-report measures of attitudes toward teachers or school work, enjoyment of school, or self-concept generally are not adequate, especially for young children, because scores are unreliable and open to powerful situational influences, besides being subject to the many other limitations of self-report measures. If and when valid and reliable affective measures do appear, they probably will be behavioral measures, perhaps ratings or situational tests of some kind. In any case, research attempting to link classroom processes to affective outcomes is unlikely to progress much until such measures are developed.

Many have suggested that paper and pencil measures of psychological differentiation (field dependence-independence), conceptual tempo (cognitively reflective vs. impulsive), locus of control, or other cognitive style variables might make important contributions to research on teaching. So far this has not occurred, although the potential remains. One problem is that the environmental antecedents of these variables are not very clear yet, so there is no consensus about what teachers should do to facilitate cognitive style development. Also, more knowledge is needed about which cognitive styles are most desirable, either in general or in certain situations. Without such guidelines, it is not clear what teachers' goals should be with regard to cognitive styles, even if a knowledge base about how to pursue those goals were developed (Brophy, 1978).

## Conclusion

In reflecting on process-outcome research on teaching in recent years, I am gratified by solid progress, but also aware of a growing sense that we need to move beyond the large field study paradigm that

has served us well but now seems obsolescent. Many believe that the logical place to go from here is toward more experimental work, systematically testing causal hypotheses implied by process-outcome studies. I believe this myself, to a degree, and have conducted such a study (Anderson, Evertson, & Brophy, 1979). For certain variables, especially those relating to classroom management, enough knowledge exists to allow us to conduct such experiments sensibly. The time is not yet right (if indeed it ever will be) for the classical experiment that holds everything else constant in order to manipulate a single variable. We can, however, conduct useful experiments that involve *treatment packages* containing several elements (Snow, 1974) and even options (cf. Brophy, Note 25).

Perhaps more important at this point than conducting new experiments is solidifying recent gains by identifying process-process and process-outcome relationships that replicate, and then becoming immersed in the data until their meanings and relationships can begin to be explicated. This applies at least as much to process-process relationships as to process-outcome relationships, and will require sustained analysis of existing data, development of finer distinctions among classroom processes so that more specific categories can be identified, and a patient, determined effort to identify relevant context factors.

By implication, this means resisting accountability concerns and other pressures to translate research findings into a form that can support schemes to evaluate teachers, especially where such translation would be premature or oversimplified. In this regard, my call for better specification of process variables and more investigation of their relationships to one another and to contexts is similar to the message

of Deitz (1978), who fears that overemphasis on the social implications of applied behavior analysis research may create an unbalanced emphasis on dependent variables (product variables, here) over independent variables (process variables, here). This will also mean resisting pressures to concentrate on innovations in curriculum or instruction rather than on traditional classrooms.

Our educational system changes by evolution, not revolution. Although fads come and go and their worthwhile elements become assimilated into the traditional mainstream, the mainstream itself continues and is likely to do so indefinitely. Many see this as unfortunate. My own belief is that, although nothing in it is perfect, many of the mainstream's prominent features (group instruction, lecture/demonstration, drill/recitation, discussion, seatwork and other practice exercises, creative writing projects, research projects, and other practice/application opportunities, and testing, among others) persist because they are generally effective. From a cost/benefit perspective, they allow teachers to use methods which are feasible within existing constraints to make the most progress with the most students toward the most goals (see also Good, 1979). Be this as it may, it seems obvious that the traditional classroom is not going to go away, so it behooves researchers to study it, especially its enduring aspects.

In the long run, this will be done most effectively if researchers approach classroom variables (presage, context, process, and outcome) in an analytic and scientific way, holding hypotheses and commitments lightly. As knowledge accumulates, they will be in a much better position to make scientifically based decisions about teaching than they are today. Even so, research on teaching will never yield simple answers about what kind of teaching is optimal, even for a particular

group of students within a specified context. It can provide information about the linkages between variables, and can even specify cause and effect relationships between processes and outcomes, but it cannot order outcomes in priority; this is a question of social policy rather than science. The best science can do is provide an empirically based summary of the tradeoffs to be expected if various policy decisions are implemented (it appears that most policy decisions will involve genuine tradeoffs rather than a clear advantage of one decision over another).

Ultimately, knowledge about teaching will have to be integrated with findings from related areas such as developmental, clinical, and educational psychology, and educational curriculum and methods. This is easiest to see when researchers try to specify appropriate outcomes. What are appropriate expectations for students during and immediately after particular educational experiences? What is the meaning of performance on achievement tests, in the context of other things that society values? Are there alternative or additional ways that educational outcomes should be monitored?

Knowledge about presage, context, and process variables must also be integrated with broader considerations. For example, my own training in developmental psychology has helped me understand why certain teaching practices would be effective with preoperational students learning basic skills in the early grades, but not with students in the middle and upper grades (or vice versa). My training in clinical psychology has helped me make qualitative distinctions among different kinds of teacher praise and criticism, and to develop differential predictions about the probable effects. However, my relative unfamiliarity with curriculum as a general field and with specific curriculum areas in particular is undoubtedly an area of

weakness in my own work. A different pattern can be seen in work by Good and Grouws (Note 5), where expertise in the teaching of mathematics is evident, or in the work of Becker, Engelmann, and Carnine (Becker and Engelmann, Note 17; Carnine, 1976) where molecular interactions between curriculum development options and instructional method options have been investigated as part of the task of developing the DISTAR program.

Ultimately, we need to move far beyond the box score approach used by Dunkin and Biddle (1974) and Rosenshine and Furst (1973) to inventory findings in research on teaching. Dunkin and Biddle provided a glimpse of the future when they subdivided their summary tables according to types of variables (presage, context, process, product), but I hope to see knowledge of research on teaching and teaching itself become much more differentiated and elaborated than this. Ultimately, researchers should be able not only to point to clear, replicated patterns establishing certain findings within a particular domain as the norm, but also to be able to explain why any exceptions to this norm occurred, rather than having to report them as unexplained anomalies.

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